Utrecht University

JOINT WORKSHOP

Coping with Urban and Infrastructural Heterogeneity

Sustainable Energy Transitions in Dar es Salaam and Maputo

Partners

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Place
Regency Park Hotel, Dar es Salaam, Tanzania

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Introduction

On 22 January 2020, a Dutch – Tanzanian – Mozambican research consortium organized a joint workshop: *Coping with Urban and Infrastructural Heterogeneity – Sustainable Energy Transitions in Dar es Salaam and Maputo.* The workshop was held at the Regency Park Hotel in Dar es Salaam and gathered a group of researchers and experts in energy and urban planning sectors to examine how more place-based strategies could be applied to address heterogeneous and uneven access to electricity at a metropolitan scale in African cities. The joint workshop built on expert interviews and previous 'community of practice' meetings conducted in Maputo and Dar es Salaam over the previous two years.

The workshop participants comprised professors and researchers from Ardhi University (Tanzania), Eduardo Mondlane University (Mozambique) and Utrecht University (the Netherlands); officials from the Tanzanian Ministry of Energy and the Tanzanian Electricity Supply Company (TANESCO); Electricity of Mozambique (EDM); Tanzania's Energy and Water Utilities Regulatory Authority (EWURA); and Dar es Salaam City Council (DDC); and a donor coordinator of the Energy Working Group (see Annex). For the first time, the workshop brought together two communities of practice, as Mozambican urban planners and officials from EDM's offices in Maputo joined the stakeholders from Dar es Salaam for this day of intensive discussions and exchange of experiences. The discussions were lively, and helped to enhance the participants' knowledge on the relationship between the planning of electricity infrastructure and bottom-up urban development dynamics in both cities.

Opening Remarks

Dr Daniel Msangi, Ardhi University, Tanzania

Dr Msangi welcomed all participants to Dar es Salaam and particularly to the midterm review joint workshop. He gave a short recap on the previous workshops and then gave an overview of the programme. Thereafter, he provided information on logistics and wished all participants a productive workshop.

Research Project Overview

Prof. Jochen Monstadt, Utrecht University, the Netherlands

Prof. Monstadt reminded the participants that the workshop was a part of the mid-term evaluation activities of the research project *Coping with Urban and Infrastructural Heterogeneity – Sustainable Energy Transitions in Tanzania and Mozambique (Urban-HIT*), financed by Dutch Science Organization (NWO)'s Global Challenges programme. He explained that the project is focused on delineating pragmatic pathways to improve sustainable energy provisions in African cities, drawing on ongoing experiences in Dar es Salaam and Maputo. He underscored that the overall goal of the project is dedicated to finding out how utility companies and governmental agencies address the challenges of sustainable energy provisions in rapidly urbanizing societies, and how research projects such as this one can lead to policy recommendations. He further informed participants that the aim of the workshop was to understand how to align different frameworks to assess the sustainability of projects that are increasingly framed under the banner of achieving the Sustainable Development Goals (SDGs) by 2030.

Session 1
Strategies for electricity provision in different neighbourhoods in Dar es Salaam and Maputo

Speakers
Eng. Amilton Alissone, Electricity of Mozambique (EDM), Mozambique
Eng. Mposheleye Mwasenga, Tanzania Electric Supply Company (TANESCO), Tanzania

The focus of this session was on the current practices of energy provisions at the metropolitan scale by national public utility companies, namely EDM in Maputo and TANESCO in Dar es Salaam. Both companies are vertically integrated with strong mandates from the central government, mainly the Ministry of Energy, influenced by donor funding and conditionality. The conditionality and government policies are increasingly shaped by SDGs, especially SDG7: 'Sustainable and Modern Energy for All' by 2030.

First, Engineer Alissone explained how EDM was transforming itself to meet the demands of achieving SDG7. The EDM had recently transformed the institution into two new directorates: the Social Energy Directorate, separate from the Business Directorate, specifically created for the universal electrification strategy. In November 2018, the president Nyusi of the Republic of Mozambique launched *Energia para Todos* (Energy for All) programme, and EDM and the World Bank – which are financing the programme – started to discuss how to achieve this.

Following the discovery of one of the largest natural gas deposits in the world in the Rovuma Basin off the coast between Tanzania and Mozambique, EDM aims to become the regional hub of energy provision. In 2018, the government published the 10-year National Electrification Strategy in order to indicate the direction of the transformation. This document serves as an integrated masterplan, which incorporates masterplans from different utility companies such as gas and renewable electricity. In order to enhance financial sustainability, the strategy also includes the digitalization of major parts of the company's operations. In addition, the company started to review procurement processes and ethical codes of conduct. To meet the SDGs, the company strives to achieve 40% of female representation by 2030. This requires new educational programmes.

Second, Engineer Mwasenga described TANESCO's strategy for electricity provision in different neighbourhoods in Dar es Salaam. Just like EDM, TANESCO is a parastatal organization under the Ministry of Energy, and its mandate is to achieve universal access to electricity. Eng. Mwasenga, who is head of the Revenue Protection Unit, emphasized the importance of ensuring financial viability through revenue improvement and the reduction of energy losses. Efforts towards revenue protection have so far comprised changing from old and analogue meters to smart meters, the installation of software for tracking energy consumption patterns geared towards detecting cases of energy theft, and the improvement of revenue collection methods.

Amilton Alissone giving a presentation on EDM's electrification strategy in Mozambique

Eng. Juma Mkobya (Ministry of Energy) added that TANESCO has masterplans for electrification in Tanzania. There are two types of masterplans: a road map for electricity generation and transmission, and an urban masterplan for distribution. Each utility supply company (providing a public service, e.g. water, telephone, road, etc.) has its own masterplan. With the exception of the Dodoma region, where the plans of different utility companies have been integrated, in the rest of the country each utility company has its own plan and there is hardly any integration. Challenges arising from uncoordinated plans of different utility companies are more severe in large cities like Dar es Salaam and in the unplanned peri-urban areas. However, a representative from the Dar es Salaam City Council noted that the problem of missing institutional coordination will be addressed by the implementation of the Dar es Salaam Metropolitan Project, in which all utility companies will be involved. In order to achieve this, a General Master Plan (GMP) is being prepared, to be followed by a Strategic Plan that will also involve all utility companies.

Eng. Alissone (EDM) clarified that the integration of masterplans was primarily for the purpose of integrating operations: electricity generation, distribution and commercialization (in the same masterplan). And it entails discussions with all other sectors, not only in the public sector but also in the private sector. In Mozambique, there is a discussion on how to integrate implementation, not only to integrate masterplans.

The discussion with the audience focused on *who* funded and actually prepared the masterplans. In Tanzania, the current masterplan was completely funded by Japan International Cooperation Agency (JICA) in 2016. The national team of experts comprised professors from the University of Dar es Salaam, officials from TANESCO and regulators (EWURA).

In Mozambique, the experts creating the masterplan are mixed: EDM has its own planning department, and it initiated the planning. But in the process, it needs to deal with other foreign donors. The previous masterplan was supported by the Swedish International Development Agency (SIDA). Currently, with the natural gas and needs for renewable energy development, this masterplan is being updated by EDM and the World Bank as the integrated one.

Session 2
Research findings: diversity of electricity infrastructures and energy theft challenges

Speakers
Mr Mathias Koepke, Utrecht University, the Netherlands
Dr Daniel Msangi, Ardhi University, Tanzania

In the second session, two major empirical research findings from the research project were presented. In the first, Mr Koepke outlined the diversity of electricity infrastructures in six neighbourhoods in Dar es Salaam, complemented by some preliminary research findings on the similar diversity observed in Maputo metropolitan area. He explained the nexus between applicable energy provision technologies and different urban development patterns. He established the 'typology' of energy configurations and their respective challenges in order to underscore the need for alternative solutions for electricity supply in rapidly growing cities like Dar es Salaam and Maputo. The alternative electricity provision outside or in relation to the universal grid indicates the existence of both various capacities of users and place-based challenges. In order to capitalize on the user capacities while addressing the challenges, more place-based electrification and energy transition strategies could be envisioned.

Mr Mathias's presentation was followed by Dr Msangi's presentation on two specific settlements: a mixed-low income settlement and a high income settlement. In each settlement, he investigated the practice of energy theft in detail. Energy loss and revenue protection present one of the most important challenges for a company like TANESCO to deal with.

Using TANESCO's data, Dr Msangi showed that most of the large-scale energy theft and thus revenue loss to the company took place in Dar es Salaam compared to the rest of the regions in the country: 62.5% of revenue loss was recorded in Dar es Salaam, and 54% of all reported energy theft cases were in Dar es Salaam. Poor people stole electricity because they cannot afford to pay connection charges and user fees. Others reasons include the sheer bureaucracy related to electricity connection and complicated procedures. According to his findings, "Rich people in

Daniel Msangi giving a presentation on energy theft in Dar es Salaam

high income neighbourhoods are stealing a lot of energy compared to low income people living in middle and low income neighbourhoods". He detailed the practices of *Vishoka* – trained electricians who work independently from but resemble official TANESCO functionaries. *Vishokas* facilitate energy theft, and go so far as to blackmail their customers if they refuse to comply with their demands.

Both presentations showed the necessity to think about policy guidelines and interventions to deal with the place-based challenges to energy access, affordability and illicit practices. They clarified that different socio-technical constellations presented different energy problems, which were specific to settlements with certain characteristics, and hence call for differentiated and place-based interventions.

Session 3
Discussion: governance challenges and potential solutions towards sustainable energy transitions

Moderator
Prof. Jochen Monstadt, Utrecht University

Mr Koepke opened the discussion on the challenges of governing the common situations observed in the research so far in Dar es Salaam and Maputo. He outlined four key constellations that highlight the current different electricity provision and management challenges:

1. Conventional network extension in peri-urban areas.
2. Implementing premium network conditions in specific neighbourhoods.
3. Back-up and grid provision from retailers.
4. Dealing with electricity theft.

Prof. Monstadt moderated the discussions on each challenge as follows.

1. Conventional network extension

The challenges facing the conventional network extension is **the need to coordinate implementations of infrastructure planning and urban planning**. As cities like Dar es Salaam and Maputo grow very fast, spatial extension of the grid is largely demand-led and often unplanned. Urban planners and utilities therefore need to first coordinate with each other to plan infrastructure and its corridor development. More importantly, sectoral budgets and the time when funds are available are different for each utility company and city council. This makes it difficult to undertake joint actions for project implementations and align the priorities of the different utility companies. Utility

companies and city councils seldom have an opportunity to share with each other their own priorities in terms of what to do and where to do it. Understanding local knowledge to ensure community engagement is also a challenge.

Eng. Mkobya (Ministry of Energy) pointed out that in Dar es Salaam, the coordination team was launched to align the planning practices of the city, municipality, the Ministry of Land, all the other relevant institutions including TANESCO, the Ministry of Energy, water and telephone utility companies. The team, for example, jointly plans overhead and underground conventional network line extension. However, as most of the neighbourhoods are not properly planned, and in peripheral areas, such coordinated planning can only incrementally happen.

Mrs Mwanamukuu Kanizio (EWURA) also pointed out that it would be important to have a plan *before* people start settling down.

Municipal planner Mrs Grace Mbena (Dar es Salaam City Council) underscored the lack of coordination between the city and different utility companies as indeed being problematic. In Dar es Salaam, about 75% of planned settlements are connected to the electricity network. But there is still a need for strategic planning and institutional coordination to implement transport infrastructure, road transport and railway transport, together with water, drainage and sanitation. Further for electricity, the planning requires a general masterplan.

Eng. Alissone (EDM) intervened here, pointing out that the planning itself would not be a problem. The problem of countries like Tanzania and Mozambique with limited resources is implementation. He said:

> We can plan as a response to pressure from the people. People move to places with little or no infrastructure to support their lives. It often follows that people are not moving to the same places; hence they create uncoordinated and sporadic settlements. This raises a challenge of how to deal with this movement of people and the sporadically and uncoordinated settlements that are created.

Consequently, the problem is how to spontaneously requalify built settlements while planning takes place. In a nutshell: "You cannot fly while still building the plane…"

Discussion on settlement requalification drew much attention at this point as urban planner Eng. Julião Melo Junior (Municipality of Maputo) shared his experience.

> Suburbs expand without organization. In Maputo we reorganize the spontaneous settlements. They are different from uninhabited areas – *zona livre* or free zones – where people start living. Unoccupied areas are without inhabitants, and we have freedom to plan it. We can think of infrastructure without much difficulty for the city. But… the process of implementation depends on the financial viability and when the finances are made available. The coordinated infrastructure implementation takes time, and people start settling in the areas in disorganized manners and it becomes an unplanned settlement. And then the plan doesn't work. We cannot oversee and inspect entire areas in the city. That's how informal settlements expand. When we need to requalify these areas, the planning and implementation turn out to be very expensive.

This experience from Maputo underscores the importance of spatial planning, prequalifying areas that are ripe for urban development and the subsequent provision of services prior to people settling in them. In this way, it is easy to integrate the plans of the different utilities without necessarily having to resettle people and incur extra expenses. The timing of the release of finances is also important, as it allows room for aligning not only the plans of the different utilities, but also priority and budget limits.

2. Premium network – reliability in industrial districts and wealthy neighbourhoods

One main challenge for network provision is **the issue of reliability**. In industrial districts and wealthy neighbourhoods, reliable energy provisions are expected. When blackouts become an issue, generators are usually installed in wealthy neighbourhoods. When considering an option for preferential treatment for different neighbourhoods – like subcontracting to private companies – it was noted that such arrangements cannot be made at the moment because they are not supported by the existing regulatory framework. The reliable energy provision and backup systems should be provided for and supported by the legal/policy framework. Eng. Mkobya (Ministry of Energy) noted that in 2019, a study on the"cost of service" was conducted for customers who are ready to pay some extra cost for reliable energy supply, such as a big back-up system. However, it has not yet been implemented.

Eng. Alissone (EDM) explained that there was no discrimination between industrial and normal residential areas in Maputo in relation to the need for reliable power supply (though the priority would be given to sensitive areas such as hospitals, the head of state's house, schools, etc. in times of energy scarcity or system breakdown). The operational team would need to pay close attention to key performance indicators (KPIs) in order to increase reliability. The underground network is usually more reliable.

In Mozambique, the legal framework allows industries to do whatever they need to improve the reliability. If EDM's conventional grid and energy provision are not reliable enough for large industries to operate uninterrupted, the industries should obtain energy from wherever they can using their own resources; one option is self-generation. For example, the biggest smelter in Mozambique – MOZAL – gets its electricity from ESCOM in South Africa. ESCOM, EDM and the utility in Swaziland established a joint venture company to enable the distribution. Heineken in Mozambique operates by running its own generation plant.

As a public company, EDM focuses on access to domestic households, to increase the current 32% access rate.

3. Backup provision and grid provision by subcontract retailers.

The challenge of the alternative solution observed in various neighbourhoods where unofficial retailers provide electricity connections is rooted in **tariff issues**. Mrs Kanizio (EWURA) pointed out that in order to ensure effective revenue collection, regulators would want TANESCO to increase the tariff, but this had not been standardized. Prof. Monstadt then asked whether it would not be politically very important to connect the poor people. But in many cases, poor people living in rental houses have to pay high tariffs because they are tenants and do not have their own meters to benefit from lifeline tariffs. The owner often needs to invest in a private backup system, which could become more expensive.

In Dar es Salaam, meters are regularly checked and improved. In Maputo, EDM owns the meters and 99% of the customers are prepaid.

Eng. Alissone (EDM) gave an example of a tourist area called Vilanculos. The government gave a mandate for a private company to provide quality electricity in the area, also to boost tourism. But people could not afford the tariff for reliable electricity. People started to complain. So EDM stopped the company from supplying energy and connected the customers to the national grid for lower tariff.

Eng. Mkobya (Ministry of Energy) mentioned the Ministry's energy storage pilot project. In order to improve reliability, storage – such as batteries – should be installed. He said that discussions had started at the national level about the costs and benefits.

4. Electricity theft

The last challenge is **the electricity theft that both poor and rich people practice**. At EDM, this issue was framed as a non-technical (or commercial) loss, and this led to the formation of the Revenue Protection Directorate. The French Development Agency (AFD) supported the company to do studies into the loss, between 2015 and 2019. There are new systems, such as the network customer information system (NCIS) which is used to control and trace electricity theft. But the company has not been quite effective in this undertaking. After all, the issue of theft comes down to the issue of ethics and awareness raising.

Eng. Lukaluka Kapinga (TANESCO) explained how since 2007, TANESCO had been inspecting energy theft cases on an everyday basis. He said he recognizes that energy theft is a moral issue since not only poor people are stealing electricity, but also the rich people in government, and that even religious institutions are stealing electricity. On average, 2 years are required to reach every customer in the country, which calls for the strengthening of the revenue protection measures. Although energy theft cases are still there despite measures that have been and are taking place, revenue loss is decreasing. Of the measures, the introduction of smart meters has greatly helped to control electricity theft.

The question then is how to deal with the *vishokas*, since they are well informed about these meters. They also have networks within the government. TANESCO also recognizes that there are two types of *vishokas*: those within the company, and those outside it. On this, there were different opinions. Following Kenya's example, a utility could consider integrating the *vishokas* as operational parts of the company. Eng. Alissone (EDM) was opposed to the idea

of integrating *vishokas* in the company's operation. Eng. Kapinga (TANESCO) underscored the need to strengthen monitoring activities as well as to adopt improved systems and technologies.

Mrs Kanizio (EWURA) asserted that technological improvements alone will not solve the problem of electricity theft. In addition to scaling up awareness campaigns and adopting new systems and technologies, the need for systematic research or studies on *why* people steal energy is important. For poorer households, it is of course the tariff problem. The electricity company needs to ensure financial sustainability, because as tariffs increase, revenue loss also increases.

Session 4
Assessing the sustainability of project operation

Speakers
Eng. Lukaluka Kapinga, TANESCO, Tanzania
Eng. Amilton Alissone, EDM, Mozambique
Dr Eleusio Viegas Filipe, Eduardo Mondlane University, Mozambique

Moderator
Dr Kei Otsuki, Utrecht University, the Netherlands

The final session focused on another component of the research project's objectives: sustainability assessment of electrification projects and alignment of existing international and national standards and regulations.

First, Eng. Kapinga (TANESCO) presented the requirements for each electrification project in Dar es Salaam. The core business of TANESCO is producing, distributing and selling energy, and there is an increased awareness of **sustainable energy**. For this, the company is required to attract investment from private, national and international actors. The investments are to ensure that energy services are reliable and eventually sustainable. Rural development through electrification is another mandate. Basic services such as water, sanitation and education are also framed in relation to the availability of sustainable energy.

TANESCO has its own funding for sustainable energy purchase and sales, supplied by the government via the Rural Energy Agency, TANESCO and international donors such as JICA.

Second, Eng. Amilton (EDM) presented a project approval chart used in the company. The company follows the masterplan, although at times it is affected by pressure from the international community or the personal interests

Discussion session among participants on governance challenges and sustainability assessment

of some powerful politicians. In order to make the project process transparent, the company developed the project chart. According to the chart, the starting point is the project proposal, leading to an appropriate directorate which sends it to the specific expert who conducts evaluation. The proposal is then sent to a group of experts and officials who analyse the project. Finally, the proposal is discussed by the EDM board and is then sent back to the appropriate directorate for operation/implementation.

Through the project approval process, the company can also experience interference from politicians and other powerful groups. Political pressures are especially on the higher side during preparations for general elections. In general, the company is still guided by its masterplan. At the municipal level, the municipality's integrated plans can be used to direct EDM's electrification projects.

The project process usually starts with demands from ordinary people. Then, feasibility studies are conducted, and the technical-economic KPIs of the project are defined, and environmental impact and community assessments are conducted. KPIs are, for example, to reach 100 consumers. After the project, EDM has to evaluate how many actually got served. **These KPIs are asked for by donors like the World Bank.**

The World Bank standards are applied to procurement. When there is a large discrepancy between EDM and the World Bank regarding how procurement is done, both parties discuss the matter and reach a consensus.

The division of social and business directorates has been made also for EDM to meet KPI requirements. This was necessary so that EDM can easily determine whether investment returns for particular project proposals are low or high. In this way, the company tries to achieve the SDGs. In general, the mandate for social electrification has been in place for the past 13 years, but universal electrification for all has not been realized. There are certainly tensions between economically viable projects versus social projects. Public – private partnerships (PPPs) are seen as useful to ease these tensions.

At this point, Eng. Mkobya (Ministry of Energy) pointed out that Tanzania's situation was not very different. TANESCO receives donor support from Korea and Japan, so the company was required to follow their conditionalities. But as we saw in the controversial dam construction, donors did not support the construction and the government funded it by itself. The donors now cooperate for the environmental impact assessment.

Lastly, Dr Viegas Filipe (Eduardo Mondlane University, Mozambique) gave a presentation on the importance of aligning different frameworks to assess the sustainability of electrification projects in Maputo, based on his interviews with key informants at EDM and the Ministry of Energy in Mozambique. The division of social and economic directorates at EDM, for example, can be considered institutional compartmentalization of a public utility that aims to cope with the requirements to meet SDGs while ensuring financial feasibility. The PPPs are also understood as the coping mechanism for the company to meet different international and national requirements and the limited institutional capacity of a public utility that needs to outsource operations as electrification projects expand.

Suggestions for future research activities

Several recommendations on the way forward were presented. These include:

- For practitioners, the issue of **tariffs**, especially around the landlord – tenants relationship, is of great interest. Sharing experiences from other African countries would be helpful.
- It is important to link the research and other main development pillars such as agricultural development and tourism. Of paramount importance here is to understand how tariffs on agricultural land in urban settings are a problem for utility companies. This draws its background from Mozambique and essentially profits EDM, because in Mozambique whoever practices agriculture enjoys a special tariff.
- There is also concern about **how to address climate change mitigation** in African cities, as governments aim to increase the consumption of energy through "productive use". Reliance on hydro dams that are not currently environmentally sustainable is also an issue to be reflected upon in this context.
- The target group(s) that this research is focusing on needs to be clear. In Tanzania, the obvious audience will be the Ministry of Energy and policymakers in the energy sector, Ministry of Finance and Planning, Parliamentary Energy Committee, International Energy Committees, international and national NGOs, and donors. It is important to establish a strategy to reach them.
- It is necessary to think about disseminating the knowledge generated by the research. How will outputs be delivered to whom (i.e. who are the different stakeholders – ministry, utility, people with influence in the utilities)? What will be **the methods of communication**? The communication methods can include meetings with utility company directorates, private sectors and relevant ministries (to suggest possible reforms). It is important to create different kinds of messages for different audiences. Workshops are a way of generating effective messages; but good materials to convey the messages are important, such as short policy briefs that can be read by the secretary, advisor and even the minister.
- Producing short clips from case studies with real stories for the different partners.
- Ardhi University in Dar es Salaam and Eduardo Mondlane University in Maputo should coordinate the process of streamlining the agreed options for the way forward. These options include inviting senior people from the management to participate in future workshops.

Annex: List of Participants

Names	Organization
Amilton Alissone	Electricity of Mozambique (EDM)
Eleusio V. Filipe	Eduardo Mondlane University
Julião M. Junior	Maputo Municipality
Tuntufye Kajela	Tanzanian Electricity Supply Company (TANESCO)
Mwanamkuu Kanizio	Energy and Water Utilities Regulatory Authority (EWURA), Tanzania
Lukaluka Kapinga	TANESCO
Mathias Koepke	Utrecht University
Sidonio Mabjala	EDM
Grace, B. Mbena	Dar es Salaam City Council
Juma Mkobya	Ministry of Energy, Tanzania
Jochen Monstadt	Utrecht University
Daniel Msangi	Ardhi University
Marlino Mubai	Eduardo Mondlane University
Mposheleye Mwasenga	TANESCO
Kei Otsuki	Utrecht University
Tajiel Urioh	Donor Coordination (EDPG & The Green Icon)